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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/529,020	10/06/2005	Yan Gao	NRC-6	8814

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EXAMINER	
DOLLINGER, MICHAEL M	
ART UNIT	PAPER NUMBER
1796	

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06/03/2009	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/529,020	GAO ET AL.	
	Examiner	Art Unit	
	MICHAEL DOLLINGER	1796	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *27 February 2009*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *15,16,18,25,33 and 34* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *15,16,18,25,33 and 34* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

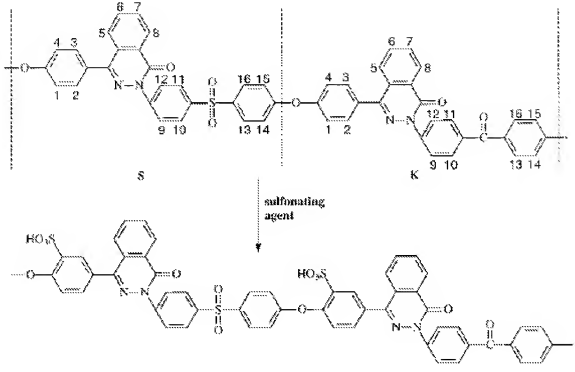
Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 15,16, 18 and 25 are rejected under 35 U.S.C. 103(a) as being obvious over Dai et al (Synthesis and characterization of sulfonated poly(phthalazinone ether sulfone ketone) for ultrafiltration and nanofiltration membranes. Journal of Applied Polymer Science. Vol. 79 No. 9 pages 1685-1692).

3. Dai et al disclose sulfonated poly(pthalazinone ether sulfone ketone) copolymers (SPPESKs) formed by the following reaction:



[Scheme 1 page 1687].

The sulfonating agent may be 98% concentrated sulfuric acid or 20-25% fuming sulfuric acid [page 1686 left column paragraph 3]. The polymer shown above has a DS of 200% [Scheme 1 note page 1687] which appears to correspond to a DS of 1 according to the present claim 15. (A DS of 200% in Dai et al, shown above, contains one sulfonic acid group per repeating unit, and Examiner interprets claim 15 to claim a DS of 1 has one sulfonic group per repeating unit.) The polymers may be cast into membranes [page 1690 left column paragraph 1]. Dai et al disclose that the DS is dependent on the reaction time and the strength of the sulfonating agent, specifically DS increases with the solution concentration of SO_3 [page 1688 right column paragraph 2; Figure 3].

4. While the above disclosed polymer contains an additional sulfone phthalazinone structural unit, it still reads on the polymer of structural formula I in claim 15. There is no claim language or features of structural formula I that exclude other monomer units.

5. Fuming sulfuric acid is a mixture of H_2SO_4 and SO_3 and concentrated sulfuric acid is a mixture of H_2SO_4 and water. When fuming sulfuric acid and concentrated sulfuric acid are mixed, the SO_3 molecules react with the water molecules to produce H_2SO_4. Fuming sulfuric acid is inherently a mixture of concentrated sulfuric acid fuming sulfuric acid and a supersaturated aqueous sulfuric acid solution. Henceforth, changing the solution concentration of SO_3, as taught by Dai et al and discussed above, is equivalent to varying the ratio of concentrated sulfuric acid to fuming sulfuric acid in the sulfonating agent as claimed in claim 18.

6. The SPPESK disclosed in Dai et al and shown above in Scheme 1 does not show a sulfonic acid group on the phenyl group attached to the ketone group, as claimed in claim 15. Dai et al do discloses that polymers with a DS > 200% will sulfonate on the H14/H15 site [page 1688 2nd full paragraph]. This corresponds to polymer of claim 15 with a DS > 1. A *prima facie* case of obviousness exists where the claimed ranges and prior art ranges do not overlap but are close enough that one skilled in the art would have expected them to have similar properties. See *Titanium Metals Corp. of America v. Banner*, 778 F.2d 775, 227 USPQ 773 (Fed. Cir. 1985).

7. Regarding claim 18, Dai et al do not disclose a sulfonating agent as a mixture of 95-98% concentrated sulfuric acid and 27-33% fuming sulfuric acid with different acid

ratios. However, Dai et al do disclose sulfonating agents of 98% concentrated sulfuric acid and 20-25% fuming sulfuric acid [page 1686 left column paragraph 3].

8. It is *prima facie* obvious to combine two compositions each of which is taught by the prior art to be useful for the same purpose, in order to form a third composition to be used for the very same purpose. See *In re Kerkhoven*, 626 F.2d 846, 850, 205 USPQ 1069, 1072 (CCPA). It would have been obvious to one having ordinary skill in the art at the time the invention was made to have combined 98% concentrated sulfuric acid and 20-25% fuming sulfuric acid in order to make a sulfonating agent for PPESK polymers. One having ordinary skill in the art would have also at once envisaged a ratio of 1/1 of the concentrated sulfuric acid and fuming sulfuric acid, corresponding to a ratio of 5/5 as claimed in claim 18.

9. While the disclosed 20-25% fuming sulfuric acid does not overlap with the claimed 27-33% fuming sulfuric acid, the ranges are close enough that one having ordinary skill in the art would expect them to have the same properties. A *prima facie* case of obviousness exists where the claimed ranges and prior art ranges do not overlap but are close enough that one skilled in the art would have expected them to have similar properties. See *Titanium Metals Corp. of America v. Banner*, 778 F.2d 775, 227 USPQ 773 (Fed. Cir. 1985).

10. Claims 33 and 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dai et al (Synthesis and characterization of sulfonated poly(phthalazinone ether sulfone ketone) for ultrafiltration and nanofiltration membranes. Journal of Applied

Polymer Science. Vol. 79 No. 9 pages 1685-1692) in view of Helmer-Metzmann et al (US 6,214,488), and in further view of Hodgdon et al (US 3,528,858), and with further evidence provided by Larminie et al (Fuel Call Systems Explained).

11. Dai et al do not disclose a membrane electrode assembly with a solid polymer electrolyte membrane between an anode and a cathode. Dai et al do teach, however, that the membrane formed from SPPESK was stable up to 120°C and even up to 130°C [page 1691 left column paragraph 1]

12. Helmer-Metzmann et al teach that sulfonated poly(aryl ether ketones) may be used to produce a polymer electrolyte membrane [abstract] useful for hydrogen/oxygen fuel cells [column 1 lines 11-15]. The SPPESK polymers of Dai et al are poly(aryl ether ketones) wherein one of the arylene groups is a phthalazinone.

13. Hodgdon et al teach that sulfonated polymer ion exchange membranes that are stable above ambient temperatures are ideally suited for use in fuel cells [column 1 lines 23-27]. Hodgdon et al also teach that it is well understood in the art that when membranes are mounted in a fuel cell that are used in combination with an anode and a cathode [column 7 lines 9-12].

14. Larminie et al show the basic structure of a cathode-electrolyte-anode construction of a fuel cell [page 3 Figure 1.2] wherein the electrolyte is between the anode and the cathode. Larminie et al simply provide evidence that the disclosure of a polymer electrolyte membrane fuel cell inherently has an anode, a cathode and an electrolyte membrane in between the cathode and anode.

15. It would have been obvious to one having ordinary skill in the art at the time the invention was made to have produced a fuel cell with a SPPESK polymer electrolyte membrane between an anode and a cathode because Dai et al teach that it is within the skill of the art to produce a SPPESK polymer and Helmer-Metzmann et al teach that it is within the skill of the art to produce a fuel cell with a sulfonated poly(aryl ether ketone) membrane. One would have been motivated to do this because Dai et al teach that the SPPESK polymer membranes are stable up to 130°C and Hodgdon et al teach that highly thermally stable electrolyte membranes are ideal for fuel cells. Absent any evidence to the contrary, there would have been a reasonable expectation of success in producing a fuel cell with a SPPESK polymer electrolyte membrane.

Response to Arguments

16. Applicant's arguments filed 02/27/2009 with respect to Dai et al have been fully considered but they are not persuasive. Applicant argues that the disclosed polymers of Dai et al are "sulfone ketones" wherein the ketone portion is sulfonated in one location and the polymers of claim 15 are "ketones" wherein the ketone is sulfonated in two locations. This argument is not convincing because the difference between a "sulfone ketone" and a "ketone" polymer per se has been addressed since the ketone polymers of claim 15 do not exclude other monomer units. Regarding the sulfonation of a second location on the ketone portion, Dai et al disclose that at a degree of sulfonation (DS) above 200% (corresponding to a DS of 1 according to the instant

claims) the ketone portion will be sulfonated at the same location as that in the claims, addressed in the revised rejection above.

17. Applicant also argues that SPPESKs disclosed in Dai et al have a different conductivity than the claims SPPEKs and points to Figure 7 as evidence. Applicant says that Figure 7 compares the conductivity of SPPEKs to SPPESKs, however, Figure 7 actually compares the conductivity SPPESKs and SPPESs (presumably sulfonated poly phthalazinone ether sulfones). Henceforth, Figure 7 is not relevant to the claimed SPPEKs.

18. Applicant's arguments filed 02/27/2009 with respect to Dai et al in view of Helmer-Metzmann et al and in further view of Hodgdon et al and with further evidence provided by Larminie et al have been fully considered but they are not persuasive. Applicant argues that Examiner's argument that because SPPESKs are thermally stable above room temperature that it would not be expected to have utility in a SPEM system because many polymers have thermal stability and require testing to determine applicability in PEM systems. This argument is not convincing because Applicant has not addressed Examiner's entire argument including the teachings of Helmer-Metzmann et al and Hodgdon et al that teach that sulfonated poly arylene ether ketones are suitable for electrolyte membranes for fuel cells. Furthermore, even if testing is required to make a system work, it does not render the system any less obvious as long as one of ordinary skill in the art would be motivated to perform the testing and in order to arrive at the system.

Conclusion

19. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to MICHAEL DOLLINGER whose telephone number is (571)270-5464. The examiner can normally be reached on Monday - Thursday 7:30AM-6:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Randy Gulakowski can be reached on 571-272-1302. The fax phone

number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Randy Gulakowski/
Supervisory Patent Examiner, Art Unit 1796

/MICHAEL DOLLINGER/
Examiner
Art Unit 1796

/mmd/